

Patent Abstracts of Japan

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APPLICANT : NARU:KK;

INVENTOR : NAKAMURA MASAYA;

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TITLE : FOAMED POLYSTYRENE DISSOLVING AGENT

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FUJII TSUYOSHI
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(54) FOAMED POLYSTYRENE DISSOLVING AGENT

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain the subject dissolving agent highly safe and not harmful to environments, by including a specific carbonate compound.

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CLAIMS

[Claim(s)]

[Claim 1] Form polystyrene solvent characterized by including at least one kind of compound

chosen from the carbonate compound expressed with the following general formula (I);

$R_1-(OC_mH_{2m})_x-O-CO-O-(C_nH_{2n}O)_y-R_2$ -- (I)

(Among the formula, even if R_1 and R_2 are mutually the same, you may differ.) The radical chosen from the group which a carbon number becomes from the shape of a straight chain which is 1-16, a branched-chain alkyl group, a cycloalkyl radical, an alkenyl radical, and an alkylphenyl radical is shown. m and n you may differ, even if mutually the same, the integer of 1-6 is shown, and even if x and y are mutually the same, they may differ from each other, and they show the integer of 0-2.

[Claim 2] The form polystyrene solvent according to claim 1 at least one kind of whose compounds chosen from the carbonate compound expressed with said general formula (I) are the inside of said general formula (I), and a compound both x and whose y are 0.

[Claim 3] The form polystyrene solvent according to claim 1 or 2 whose flash point is 21 degrees C or more.

[Claim 4] The form polystyrene solvent according to claim 1 or 2 whose flash point is 70 degrees C or more.

[Claim 5] The form polystyrene solvent according to claim 1 to 4 which contains a surface active agent at 0.1 - 10% of the weight of a rate to 100 % of the weight of carbonate compounds expressed with said general formula (I).

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention dissolves the form polystyrene used as ingredients, such as a food-grade tray and a packing agent, and relates to the form polystyrene resolvent for making recovery and reuse easy.

[0002]

[Background of the Invention] Form polystyrene is cheap, easy to fabricate, and since it excels in impact buffer nature, it is used in large quantities as shock absorbing material in the case of packing of a food-grade tray, home electronics, etc. However, since it will not be decomposed in soil if a landfill is carried out in case it discards, if form polystyrene will remain in an environment semipermanently and incineration disposal is carried out, it will generate problems, like calorific value damages an incinerator greatly at the time of incineration. Especially, importance is attached to environmental protection and the request of recycle is increasing recently.

[0003] Although the approach of making the technique which carries out recovery recycle of the form polystyrene, and pyrolyzing form polystyrene, making the oily matter of low molecular weight, and using as a fuel is examined, equipment is large-scale and cost also becomes high. Moreover, although the method of fusing and blocking form polystyrene with heat is also examined, problems, such as a physical-properties fall of the polystyrene by the cost of equipment, the installation, the odor to generate, and the pyrolysis, follow.

[0004] Although the approach of carrying out post-recovery reuse of having dissolved form polystyrene in the organic solvent and having shrunk the volume as one effective means is also examined, the flash point is low, and the usual organic solvent has an insurance top problem, and may have a bad influence on the body or an environment.

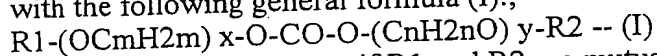
[0005] A specific carbonate compound dissolves form polystyrene easily, and this invention person came to complete header this invention for it being rare to have a bad influence on the body or an environment moreover, as a result of inquiring wholeheartedly in view of such a conventional technique.

[0006]

[Objects of the Invention] This invention solves the above-mentioned problem, its safety is high, and having a bad influence on an environment aims at offering few form polystyrene resolvents.

[0007]

[Summary of the Invention] It is characterized by the form polystyrene resolvent concerning this invention containing at least one kind of compound chosen from the carbonate compound expressed with the following general formula (I);



(Among the formula, even if R1 and R2 are mutually the same, you may differ.) The radical chosen from the group which a carbon number becomes from the shape of a straight chain which is 1-16, a branched-chain alkyl group, a cycloalkyl radical, an alkenyl radical, and an alkylphenyl radical is shown. m and n you may differ, even if mutually the same, the integer of 1-6 is shown, and even if x and y are mutually the same, they may differ from each other, and they show the integer of 0-2. It is desirable that both the inside of said general formula (I), x, and y are the compounds at least one kind of whose compound chosen from the carbonate compound expressed with said general formula (I) in this invention is 0.

[0008] Moreover, as for the form polystyrene resolvent of this invention, it is desirable for 21 degrees C or more of flash points to be 70 degrees C or more preferably. Furthermore, 0.1 - 10% of the weight of the surfactant may contain the form polystyrene resolvent of this invention to 100 % of the weight of carbonate compounds expressed with said general formula (I).

[0009]

[Detailed Description of the Invention] Hereafter, the form polystyrene resolvent concerning this invention is explained concretely. The form polystyrene resolvent concerning this invention contains at least one kind of compound chosen from the carbonate compound expressed with the following general formula (I).

[0010]

$R_1-(OC_mH_{2m})_x-O-CO-O-(C_nH_{2n}O)_y-R_2$ -- (I)

The inside of a formula, and R_1 And R_2 You may differ, even if mutually the same, and the radical chosen from the group which a carbon atomic number becomes from the shape of a straight chain, the branched-chain alkyl group, the cycloalkyl radical, alkenyl radical, and alkylphenyl radical of 1-16 is shown.

[0011] A carbon atomic number is specifically mentioned for methyl, ethyl, n-propyl, n-butyl, t-butyl, i-butyl, n-hexyl, n-heptyl, n-nonyl, n-octyl, etc. as the shape of a straight chain and the branched-chain alkyl group of 1-16, and, specifically, cyclopentyl, cyclohexyl, cycloheptyl one, etc. are mentioned as a cycloalkyl radical.

[0012] As an alkenyl radical, vinyl etc. is mentioned and, specifically, benzyl etc. is mentioned as an alkylphenyl radical. Even if m and n are mutually the same, they may differ from each other, and they show the integer of 1-6.

[0013] You may differ, even if x and y are mutually the same, and the integer of 0-2 is shown, and each of x and y is 0 preferably. As a carbonate compound expressed with said such general formula (I), in an example Dimethyl carbonate, diethyl carbonate, G n-propyl carbonate, Diisopropyl carbonate, di-n-butyl carbonate, diisobutyl carbonate, G n-hexyl carbonate, diisoheptyl carbonate, bis--2-ethylhexyl carbonate, Symmetry carbonate compounds, such as G n-octyl carbonate, diaryl carbonate, and dibenzyl carbonate; ethyl Methyl carbonate, Methyl n-propyl carbonate, isopropyl Methyl carbonate, n-butyl Methyl carbonate, isobutyl Methyl carbonate, n-hexyl Methyl carbonate, iso heptyl Methyl carbonate, 2-ethylhexyl Methyl carbonate, methyl Octyl carbonate, Methyl Nonyl carbonate, DESHIRU Unsymmetrical carbonate compounds, such as methyl carbonate; 2-methoxy ethyl Methyl carbonate, 2-isopropoxy ethyl Methyl carbonate, 2-methoxy-1-methylethyl Methyl carbonate, 2-methoxy-1-methylethyl Ethyl carbonate, 2-(2-methoxyethoxy) ethyl Methyl carbonate, Screw (2-methoxy ethyl) carbonate, screw (2-methoxy-1-methylethyl) carbonate, Screw (2-(2-methoxy-1-methylethoxy)-1-methylethyl) carbonate, Screw (2-(2-ethoxy-1-methylethoxy)-1-methylethyl) carbonate, 2-butoxy ethyl Methyl carbonate, Screw (2-butoxy ethyl) carbonate, screw (2-t-butoxy ethyl) carbonate, 2-butoxy-1-methylethyl Methyl carbonate, 2-t-butoxy-1-methylethyl Methyl carbonate, The carbonate compound which has ether linkage, such as screw (2-butoxy-1-methylethyl) carbonate and screw (2-t-butoxy-1-methylethyl) carbonate, can be mentioned. These are one-sort independent, or can be combined two or more sorts and can be used.

[0014] When using one sort of these carbonate compounds, it is desirable that the flash point uses a thing 21 degrees C or more, and it is desirable that the thing which has the high flash point, especially the flash point use a carbonate compound 70 degrees C or more from a viewpoint on insurance.

[0015] Moreover, when using two or more sorts combining these carbonate compounds, it is desirable to use the thing of the range of the above [the flash point of mixture]. Although especially the combination of two or more sorts of carbonate compounds is not limited, it has combination with a carbonate compound with the high (for example, 70 degrees C or more) flash point with the slow dissolution rate [a carbonate compound with the early low (for example, 60 degrees C or less) flash point and the dissolution rate of form polystyrene] dissolution rate of form polystyrene, for example.

[0016] although especially a mixing ratio is not limited when combining two or more sorts of carbonate compounds -- the rate of a volume ratio -- usually -- 99:1-1:99 -- it is 90:10-10:90 preferably.

[0017] The flash point is di-n-butyl carbonate, diisobutyl carbonate, G n-hexyl carbonate, diisoheptyl carbonate, and iso heptyl as a carbonate compound 70 degrees C or more here, for example. Methyl carbonate, 2-ethylhexyl Methyl carbonate, methyl Octyl carbonate, 2-methoxy-1-methylethyl There is methyl carbonate etc.

[0018] Moreover, a part of physical-properties values and biodegradability of the carbonate compound used by this invention as reference are shown in Table 1.

[0019]

[Table 1]

表 1

化合物名	分子量	密度 (g/cm ³)	沸 点 (°C)	引火点 (°C)	生分解性の 有無
DEC	118.10	0.9764	126	46	有
DNPC	149.19	0.9418	168	62	有
DIPC	149.19	0.9196	147	46	無
DNBC	174.24	0.9291	207	92	有
DIBC	174.24	0.9188	190	84	有
MHPC	174.24	0.9370	102/23mmHg	85	有
MNBC	132.24	0.9639	162	54	(未試験)
MNHC	160.21				(未試験)

DEC : ジエチルカーボネート
 DNPC : ジ-n-プロピルカーボネート
 DIPC : ジイソプロピルカーボネート
 DNBC : ジ-n-ブチルカーボネート
 DIBC : ジイソブチルカーボネート
 MHPC : イソヘプチル メチルカーボネート
 MNBC : n-ブチル メチルカーボネート
 MNHC : n-ヘキシル メチルカーボネート

[0020] The carbonate compound expressed with said general formula (I) is easily compoundable by making carbonic acid diester, such as a phosgene or dimethyl carbonate, and diphenyl carbonate, and corresponding alcohol react. Moreover, it is compoundable with the reaction of a chloro carbonate and corresponding alcohol. Although the carbonate compound expressed with said general formula (I) generated by said reaction may be obtained as one kind of case, and two or more sorts of mixture, in the case of mixture, it is also possible to separate these, and to use independently and to use it with mixture. Since these carbonate compounds have many in which toxicity is low and generally has biodegradability, it is rare to have a bad influence to an environment.

[0021] Although the form polystyrene resolvent concerning this invention contains the carbonate compound expressed with said one sort or two sorts or more of general formulas (I), it may contain the surfactant if needed.

[0022] It is desirable to be able to mention anion system surface active agents, such as Nonion system surface-active-agent; dioctyl sulfosuccinate, such as the polyoxyethylene lauryl ether, etc., and to use especially the Nonion system surface active agent as a surface active agent. The content rate of a surface active agent is 0.2 - 5 % of the weight preferably 0.1 to 10% of the weight to 100 % of the weight of carbonate compounds. If a surface active agent is added to these carbonate compounds, the dissolution rate of form polystyrene can be raised.

[0023] In addition, the form polystyrene resolvent of this invention may be replaced with said surfactant, or, in addition to said surfactant, may contain an antioxidant with a still better known hindered phenolic antioxidant etc.

[0024] When the form polystyrene resolvent of this invention contains a surfactant and/or an antioxidant, it is desirable that the flash point of the form polystyrene resolvent containing a surfactant and/or an antioxidant is in the above-mentioned range.

[0025] Although the temperature at the time of dissolving form polystyrene using the form polystyrene resolvent concerning this invention will not be limited especially if it is the temperature below the boiling point of this resolvent, it is usually below the boiling point of a resolvent beyond a room temperature, and is within the limits of 70 degrees C or less beyond a room temperature still more preferably below the flash point of a resolvent beyond a room temperature preferably. In addition, a dissolution rate can be raised if a resolvent is warmed at the time of the dissolution of form polystyrene.

[0026]

[Effect of the Invention] Since the form polystyrene solvent of this invention dissolves form polystyrene easily, and its safety is high and it is rare to have a bad influence to an environment, the effective means for recycling form polystyrene upwards and achieving reduction-ization efficiently is given.

[0027]

[Example] Hereafter, although this invention is explained still more concretely based on an example, this invention is not limited to these examples.

[0028]

[The example 1 of reference] The 200ml limonene was put into the 300ml flask furnished with an agitator, and it agitated at the rate of 100rpm at 20 degrees C. Time amount until it supplies spherical with a diameter of about 12mm polystyrene 2g to said flask and dissolves in it completely was measured. Consequently, the dissolution duration was 110 seconds.

[0029] In addition, a dissolution duration is the average (it is below the same) when performing said measurement 3 times.

[0030]

[Example 1] In the example 1 of reference, the dissolution duration of polystyrene was similarly measured except having replaced with the limonene and having used DEC. The dissolution duration for polystyrene to dissolve completely was 95 seconds.

[0031]

[Examples 2 and 3] In the example 1, the dissolution duration of polystyrene was similarly measured except having changed into the temperature which indicated the melting temperature to Table 1. The result was shown table 2.

[0032]

[Table 2]

表 2

実施例No.	温度	溶解所要時間
実施例 1	20℃	95秒
実施例 2	40℃	50秒
実施例 3	60℃	33秒

[0033]

[Examples 4-17] In the example 1, the dissolution duration of polystyrene was similarly measured except having considered as the temperature which indicated the melting temperature to Table 3 using the carbonate compound which replaced with DEC and was shown in Table 3. The result was shown in Table 3.

[0034]

[Table 3]

表 3

実施例No	溶剤	温度	溶解所要時間
実施例 4	DNPC	20℃	125秒
実施例 5	DNPC	40℃	63秒
実施例 6	DIPC	20℃	138秒
実施例 7	DIPC	40℃	55秒
実施例 8	DNBC	20℃	164秒
実施例 9	DNBC	40℃	107秒
実施例 10	MHPC	20℃	158秒
実施例 11	MHPC	40℃	95秒
実施例 12	MNBC	20℃	108秒
実施例 13	MNBC	40℃	49秒
実施例 14	MNHC	20℃	148秒
実施例 15	MNHC	40℃	89秒
実施例 16	MNBC + DNBC (20 : 80)*	20℃	122秒
実施例 17	MNBC + DNBC (20 : 80)*	40℃	75秒

* 体積比率

[0035]

[Examples 18-21] In the example 8, it examined by the same approach except having added the surfactant shown in Table 4 at DNBC. In accordance with the result, it indicated to Table 4.

[0036]

[Table 4]

表 4

実施例No	添加した界面活性剤 (vol%)	温度	溶解所要時間
実施例 18	ポリオキシエチレンラウリルエーテル (0.5)	20℃	109秒
実施例 19	ポリオキシエチレンラウリルエーテル (0.5)	40℃	72秒
実施例 20	ジオクチルスルホサクシネート (0.5)	20℃	124秒
実施例 21	ジオクチルスルホサクシネート (0.5)	40℃	88秒

TECHNICAL FIELD

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[Background of the Invention] Form polystyrene is cheap, easy to fabricate, and since it excels in impact buffer nature, it is used in large quantities as shock absorbing material in the case of packing of a food-grade tray, home electronics, etc. However, since it will not be decomposed in soil if a landfill is carried out in case it discards, if form polystyrene will remain in an environment semipermanently and incineration disposal is carried out, it will generate problems, like calorific value damages an incinerator greatly at the time of incineration. Especially, importance is attached to environmental protection and the request of recycle is increasing recently.

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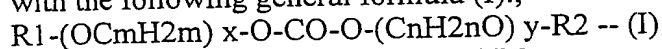
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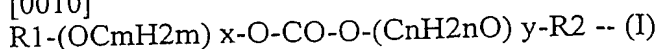
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[Table 1]

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MNBC : n-ブチル メチルカーボネート

MNHC : n-ヘキシル メチルカーボネート

[0020] The carbonate compound expressed with said general formula (I) is easily compoundable by making carbonic acid diester, such as a phosgene or dimethyl carbonate, and diphenyl carbonate, and corresponding alcohol react. Moreover, it is compoundable with the reaction of a chloro carbonate and corresponding alcohol. Although the carbonate compound expressed with said general formula (I) generated by said reaction may be obtained as one kind of case, and two or more sorts of mixture, in the case of mixture, it is also possible to separate these, and to use independently and to use it with mixture. Since these carbonate compounds have many in which toxicity is low and generally has biodegradability, it is rare to have a bad influence to an environment.

[0021] Although the form polystyrene solvent concerning this invention contains the carbonate compound expressed with said one sort or two sorts or more of general formulas (I), it may contain the surfactant if needed.

[0022] It is desirable to be able to mention anion system surface active agents, such as Nonion system surface-active-agent; dioctyl sulfosuccinate, such as the polyoxyethylene lauryl ether, etc., and to use especially the Nonion system surface active agent as a surface active agent. The content rate of a surface active agent is 0.2 - 5 % of the weight preferably 0.1 to 10% of the weight to 100 % of the weight of carbonate compounds. If a surface active agent is added to these carbonate compounds, the dissolution rate of form polystyrene can be raised.

[0023] In addition, the form polystyrene solvent of this invention may be replaced with said surfactant, or, in addition to said surfactant, may contain an antioxidant with a still better known hindered phenolic antioxidant etc.

[0024] When the form polystyrene solvent of this invention contains a surfactant and/or an antioxidant, it is desirable that the flash point of the form polystyrene solvent containing a surfactant and/or an antioxidant is in the above-mentioned range.

[0025] Although the temperature at the time of dissolving form polystyrene using the form polystyrene solvent concerning this invention will not be limited especially if it is the temperature below the boiling point of this solvent, it is usually below the boiling point of a solvent beyond a room temperature, and is within the limits of 70 degrees C or less beyond a room temperature still more preferably below the flash point of a solvent beyond a room temperature preferably. In addition, a dissolution rate can be raised if a solvent is warmed at the time of the dissolution of form polystyrene.

EFFECT OF THE INVENTION

[Effect of the Invention] Since the form polystyrene resolvent of this invention dissolves form polystyrene easily, and its safety is high and it is rare to have a bad influence to an environment, the effective means for recycling form polystyrene upwards and achieving reduction-ization efficiently is given.

EXAMPLE

[Example] Hereafter, although this invention is explained still more concretely based on an example, this invention is not limited to these examples.

[0028]

[The example 1 of reference] The 200ml limonene was put into the 300ml flask furnished with an agitator, and it agitated at the rate of 100rpm at 20 degrees C. Time amount until it supplies spherical with a diameter of about 12mm polystyrene 2g to said flask and dissolves in it completely was measured. Consequently, the dissolution duration was 110 seconds.

[0029] In addition, a dissolution duration is the average (it is below the same) when performing said measurement 3 times.

[0030]

[Example 1] In the example 1 of reference, the dissolution duration of polystyrene was similarly measured except having replaced with the limonene and having used DEC. The dissolution duration for polystyrene to dissolve completely was 95 seconds.

[0031]

[Examples 2 and 3] In the example 1, the dissolution duration of polystyrene was similarly measured except having changed into the temperature which indicated the melting temperature to Table 1. The result was shown table 2.

[0032]

[Table 2]

表 2

実施例No.	温度	溶解所要時間
実施例 1	20℃	95秒
実施例 2	40℃	50秒
実施例 3	60℃	33秒

[0033]

[Examples 4-17] In the example 1, the dissolution duration of polystyrene was similarly measured except having considered as the temperature which indicated the melting temperature to Table 3 using the carbonate compound which replaced with DEC and was shown in Table 3. The result was shown in Table 3.

[0034]

[Table 3]

表 3

実施例No	溶剤	温度	溶解所要時間
実施例 4	DNPC	20℃	125秒
実施例 5	DNPC	40℃	63秒
実施例 6	DIPC	20℃	138秒
実施例 7	DIPC	40℃	55秒
実施例 8	DNBC	20℃	164秒
実施例 9	DNBC	40℃	107秒
実施例10	MHPC	20℃	158秒
実施例11	MHPC	40℃	95秒
実施例12	MNBC	20℃	108秒
実施例13	MNBC	40℃	49秒
実施例14	MNHC	20℃	148秒
実施例15	MNHC	40℃	89秒
実施例16	MNBC + DNBC (20 : 80)*	20℃	122秒
実施例17	MNBC + DNBC (20 : 80)*	40℃	75秒

* 体積比率

[0035]

[Examples 18-21] In the example 8, it examined by the same approach except having added the surfactant shown in Table 4 at DNBC. In accordance with the result, it indicated to Table 4.

[0036]

[Table 4]

表 4

実施例No	添加した界面活性剤 (vol%)	温度	溶解所要時間
実施例 18	ポリオキシエチレンラウリルエーテル (0.5)	20℃	109秒
実施例 19	ポリオキシエチレンラウリルエーテル (0.5)	40℃	72秒
実施例 20	ジオクチルスルホサキシネート (0.5)	20℃	124秒
実施例 21	ジオクチルスルホサキシネート (0.5)	40℃	88秒